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SWISS – Innovative Discrete Interval Sampling Technology for Detection and Assessment of Contaminants in Soil and Groundwater

17th Annual Maryland Ground Water Symposium

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What is it?

- The Shedd-Weikel Interval Sampling System (SWISS) is a new type of isolation and sampling system which uses proven oil-field and water industry materials and an innovative custom design to yield a simple, cost effective solution for discrete zone sampling and isolation.

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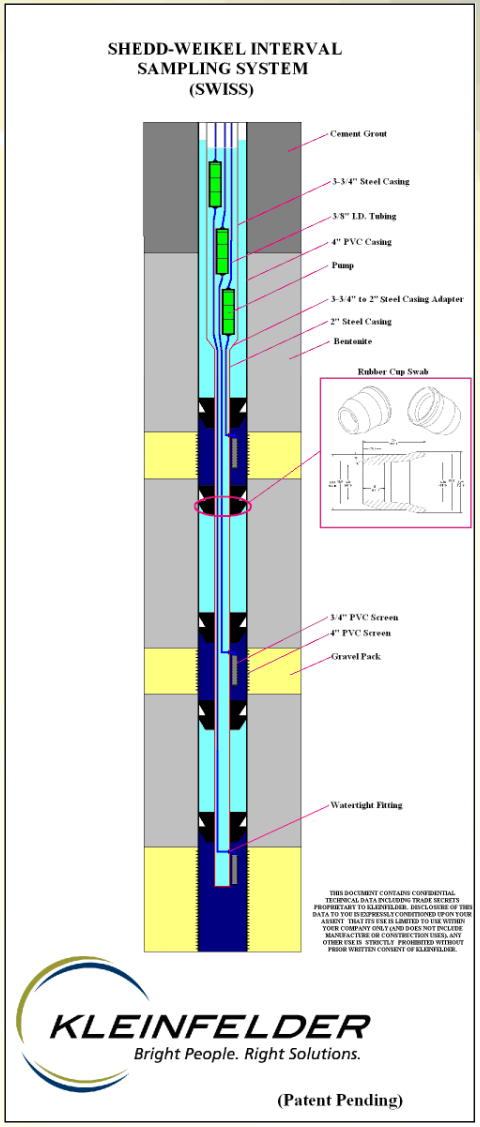
What does it do?

- The SWISS provides a simpler and more cost effective way to monitor, sample, and assess contamination in discrete zones.
- Utilizing the SWISS we are able to affordably profile contamination in the subsurface.
- The ability to adequately assess may provide alternatives for poor, rural, and other areas with contamination.

Design

- The SWISS technology is simple, taking little more effort than typical well installation.



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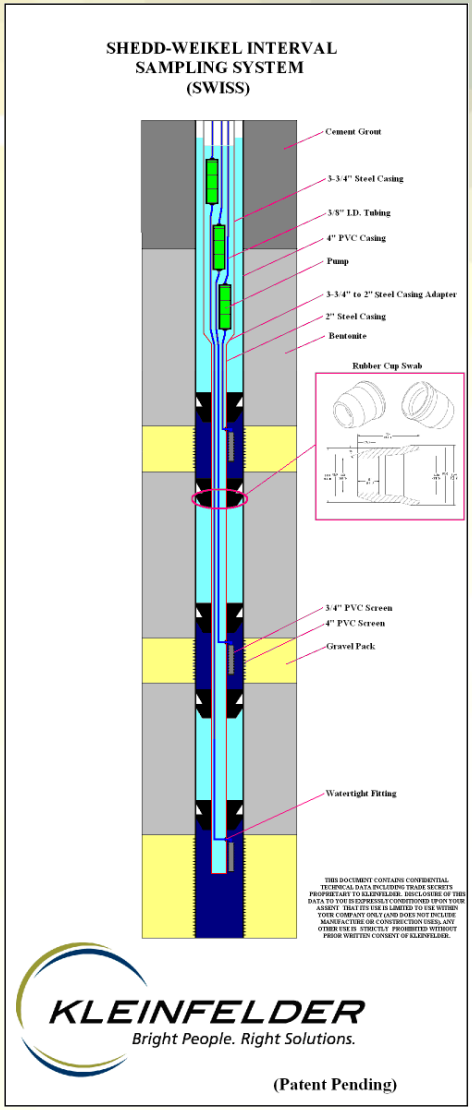
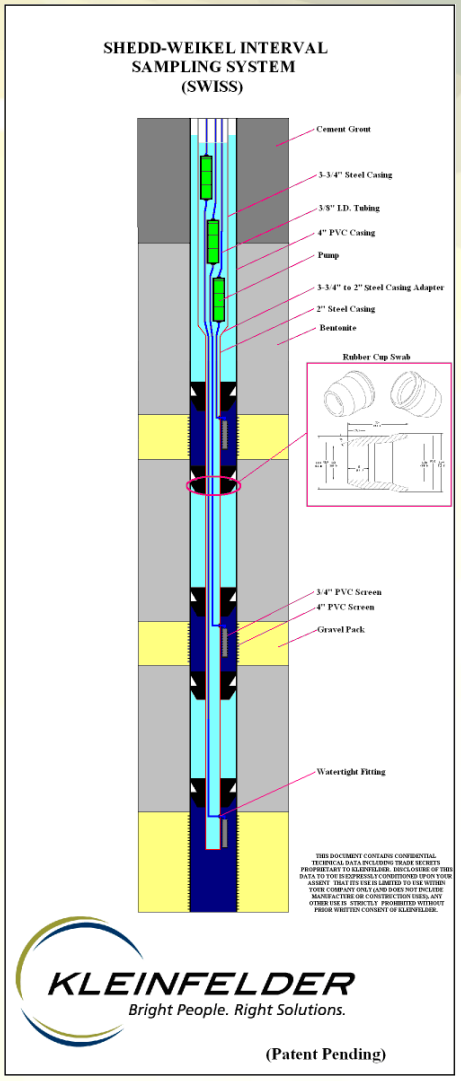
Specifications

- The standard system consists of the following components:
  - At least an 8 inch diameter borehole.
  - 4 inch diameter outer casing and screen, custom fitted for borehole specific geology.
  - Standardized well construction within the annular space between the borehole and casing.
    - Gravel pack at screened intervals.
    - Coated bentonite and/or grout for seal between screened intervals.



Specifications (Cont.)

- The standard system consists of the following components:
  - 2 inch diameter inner core "stinger"
    - Stinger is ported at each zone to be sampled with a dedicated external screen connected directly to hose which runs through the center of the stinger system to the pump
    - 2 rubber cup swabs are interlocked and placed above and below each interval to be monitored, held in place using collars
  - Due to space restrictions the standard system is configured for monitoring of 4 discrete intervals



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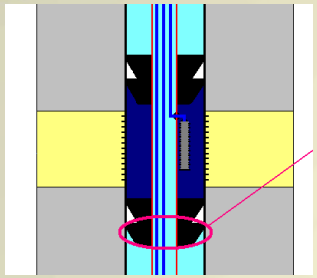
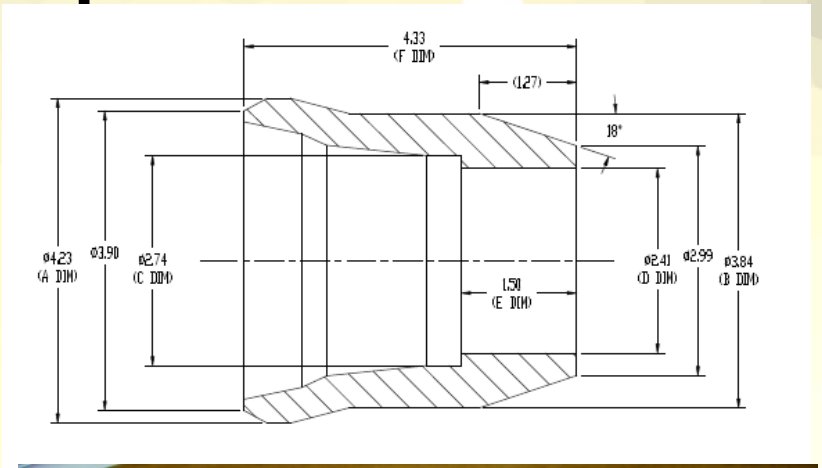
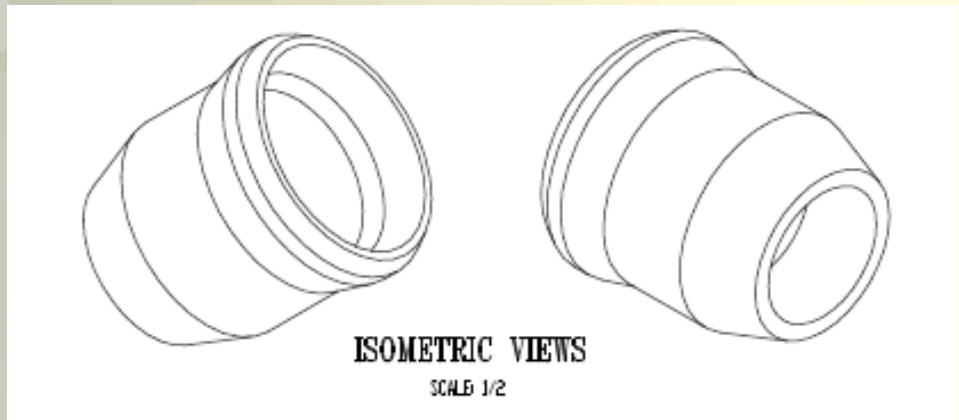
Key Components



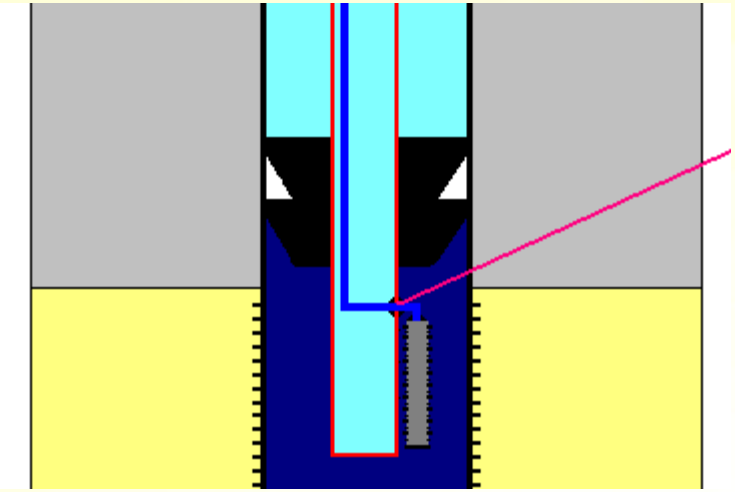


- Packer Cups, Swab Cups, and Cup Swabs (Oh my!)



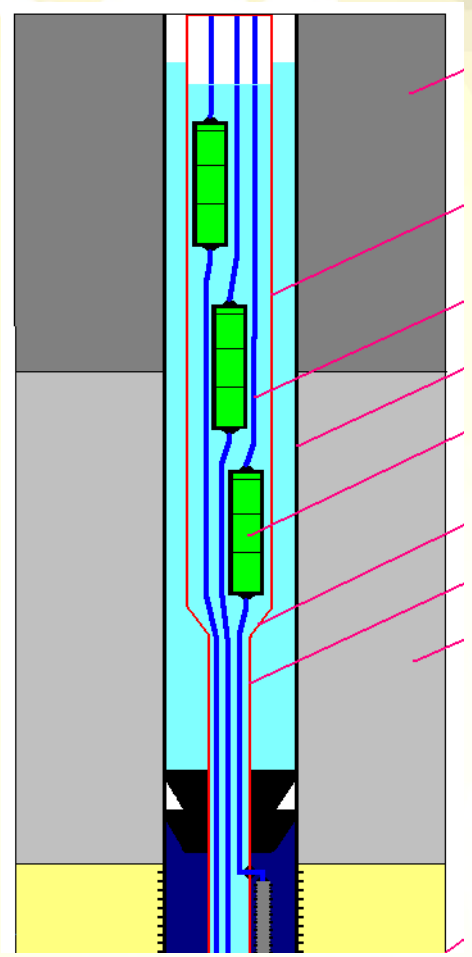
Key Components (Cont.)

- Ported lines to isolated zones allow for the core of the system to remain open for several critical advantages
  - Best of both worlds, you can screen zones of your choosing, but you also get a dedicated tube run directly to your zone of choice
  - Easier to install as inside of core does not have to be sealed at each junction
  - Provides for greater confidence in seal as one continuous line is run between the sampling port and the extraction pump



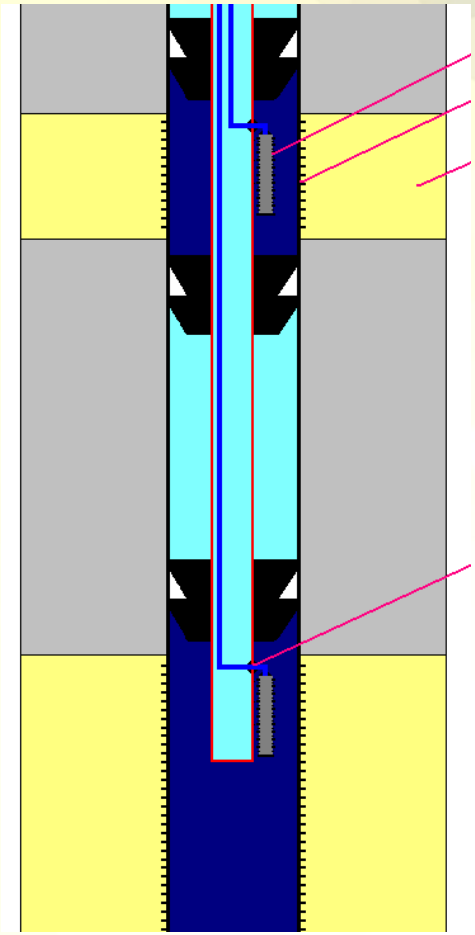
Key Components (Cont.)

- Inline Pumps
  - The system can be designed to accommodate many types and sizes of pumps
    - Because of this flexibility the system can be adapted for both assessment and remediation needs, including aquifer testing
  - Dedicated pump for each zone provides additional confidence in sample collection integrity
  - Because pumps are inline no mob of additional equipment is necessary to complete sampling



Key Components (Cont.)

- Custom screened intervals
  - Using industry standard materials any interval can be monitored or sealed
  - Well screen is placed at specified zones and the borehole is completed using sand, coated bentonite, and grout depending on site specific needs
  - A second screen is connected to the dedicated ported tubing which runs directly from the port to the pump
  - Zones can be completed above the potentiometric surface to facilitate vapor sampling and extraction



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Experimental Testing

- A simple test was devised and conducted to test the integrity of the system seal under probable conditions.
- A section of the system was completed using solid outer PVC casing and solid inner PVC casing, with a swab cup installed in the annular space between the casings.
- The system was filled with water and checked for observable change in water levels and potential exterior leakage over a period of 4 months
- The test was a success, no observable change in water level or leakage was noted

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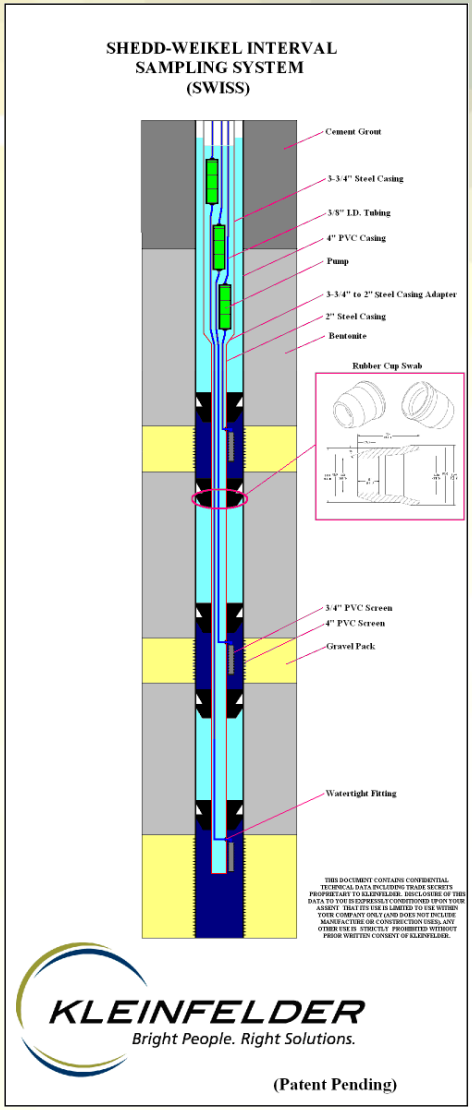
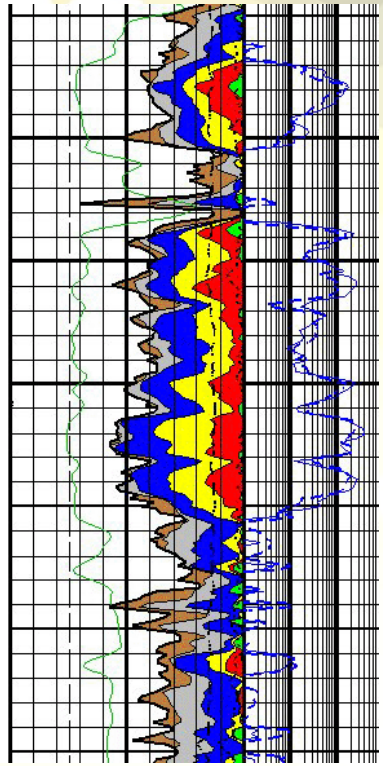
Installation

- After borehole advancement and logging, identified zones are completed using sections of screen and casing
- A gravel pack is installed at each screened interval and intervals are sealed using coated bentonite or grout
- As with any well system proper development is then necessary
- The centralized core system (stinger) is then constructed and lowered into the outer casing



Applications

- Due to the standard well type construction the SWISS can be used in a wide range of geologic materials
- The rubber cub swabs have a pressure rating in excess of several thousand pounds per square inch (psi.).
- SWISS systems can be deployed to depths up to 3,200 feet below grade without significant additional modification
- SWISS is designed to be adaptable and removable
  - The standard system is set up to monitor 4 zones, each with dedicated lines and pumps
  - Since SWISS uses dedicated pumps for each zone it means that multiple zones can be purged simultaneously
  - The system can be removed for maintenance or adaptation, such as retrofit for isolated remediation of specific zones after initial sampling assessment, ie: installation of larger diameter tubing and larger pumps



Other Capabilities and Optional Equipment

- The SWISS can be adapted to variable diameter boreholes depending on application
- The system can also be adapted for monitoring of more or less zones depending on the application
  - Monitoring of additional zones would result in a decrease in available space therefore a decrease in maximum possible flow rate; however, monitoring of fewer zones will result in an increase in maximum possible flow rate
    - The standard system (set up to monitor 4 zones) would have a maximum flow rate of ~ 7.5 gallons per minute (gpm) per zone

Other Capabilities and Optional Equipment (Cont.)

- Dedicated pressure transducers can be installed for monitoring of static and pumping head levels, data can be used to:
  - Check integrity of the seal between zones (This assumes no connectivity between zones, if zones are interconnected no true seal is possible with any system)
  - Complete aquifer testing of isolated zones or zones in combination
- The system is fully removable allowing for maintenance, retrofit, or abandonment

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How is the SWISS different from systems already on the market?

- Because the SWISS uses industry standard materials, rather than proprietary, materials can be purchased in bulk at significant savings, resulting in much lower overall project cost
- Because the SWISS technology uses dedicated pumps of sufficient capacity, a realm of pumping, testing, and remedial options is opened up which is not achieved with existing systems.
  - Aquifer testing, including measurement of levels in, above, and below the discrete zone being tested through pumping, slug, and recovery testing
  - Ground water extraction from isolated zones
  - Vapor extraction from isolated zones
  - Extraction of water or soil vapor from multiple zones simultaneously

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How is the SWISS different from systems already on the market? (Cont.)

- The SWISS is removable and highly adaptable depending upon the application
- Eliminates the need to install cluster wells for remediation, and significantly improves the level of data quality through completion of a single borehole rather than spaced wells completed to approximate zones
- Eliminates question of seal integrity due to hydrostatic pressures and provides a methodology to test seal integrity
- Can be installed in remote locations with rudimentary equipment and tools.

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How is the SWISS different from systems already on the market? (Cont.)

- The SWISS is designed with rigid materials to ensure adequate seal, material distribution, and long term reliability
- Materials used in construction can be modified based upon project needs, ie: type of contaminant; however, the materials used in standard system construction are proven in the industry to provide the best objective monitoring without release of fractionated organic carbon or other potentially altering materials
- The SWISS does not require any additional or specialized equipment for sampling, with a typical installation.

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Summary

- The SWISS technology is simple, taking little more effort than typical well installation and highly adaptable for most applications.
- The SWISS aids in sample collection, detection, and assessment of both soil and ground water conditions by creating interval isolation and mitigating the possibility of cross-contamination without the costs and difficulties associated with installation and use of currently available interval sampling systems.
- The technology allows for a testable seal within the well, provides the predictable characteristics of a standard well structure, and allows the option for removal for modification, maintenance, or abandonment

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Summary (Cont.)

- The SWISS relies on proven oil-field and water industry materials and an innovative custom design to yield a simple, cost effective solution for discrete zone sampling and isolation.
- The system can be used for remedial applications
- The patent process for this system is currently underway and system prototyping is planned with applications for a wide range of hydrogeologic environments
  - The current schedule will allow for systems to be available for installation beginning in early 2009

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Thank You.

Questions?